

Grade AH-DH-EH-FH

Mechanical properties for acceptance purposes (see Note 1)

Grade (see Note 3)	Yield stress N/mm ²	Tensile strength	Elongation on 5,65 vs 0 (see Note 2)	Charpy V-notch impact test (see Notes 4 and 5)						
				Average energy J minimum						
				t ≤ 50 mm		50 < t ≤ 70 mm		70 < t ≤ 100 mm		
				Longitudinal	Transverse	Longitudinal	Transverse	Longitudinal	Transverse	
AH 36										
DH 36	355	490 - 620	21	34	24	41	27	50	34	
EH 36		(see Note 3)								
FH 36										

Impact tests are to be made on the various grades at the following temperatures:

AH grades	0° C
DH grades	-20° C
EH grades	-40° C
FH grades	-60° C

NOTES

- The requirements for products thicker than those detailed in the table are subject to agreement.
- For full thickness tensile test specimens with a width of 25 mm and a gauge length of 200 mm, the minimum elongation is to be:

Thickness mm	≤5	>5	>10	>15	>20	>25	>30	>40	>50
		≤10	≤15	≤20	≤25	≤30	≤40	≤50	
Elongation %	13	15	16	17	18	19	20	21	To be specially agreed
Strength levels	36								

- Subject to special approval by LR, the minimum tensile strength may be reduced to 471 N/mm², for grades AH36, DH36, EH36 and FH36, in the TM condition when micro-alloying elements Nb, Ti or V are used singly and not in combination and provided the yield to tensile strength ratio does not exceed 0,89. For plates with a thickness ≤ 12mm, the yield to tensile strength ratio is to be specially considered.
- Generally, tests need only be made in the longitudinal direction. For special applications, transverse test specimens may be required by the purchaser or LR. Transverse properties for plates and wide flats are to be guaranteed by the supplier.
- Impact tests are not required when the nominal material thickness is less than 6 mm.
- For batch tested plates in a condition other than furnace normalized, with a thickness equal to 12mm or greater, and where the average value of one set of tests is less than 50J, two further items from the same batch are to be selected and tested. If these fail to achieve an average of 50J on either set, each individual piece of the heat is to be tested. The plates are acceptable provided they meet the requirements of the table above. Additional testing is not required where the manufacturer can demonstrate to the satisfaction of the Surveyor that the plate was rolled outside the limits of the programmed rolling schedule. In this instance the plate could be rejected.

Grade AH-DH-EH-FH

Chemical composition

Grades	AH, DH, EH	FH
Carbon % max.	0,18	0,16
Manganese %	0,9 - 1,60 (see Note 1)	0,9 - 1,60
Silicon % max.	0,50	0,50
Phosphorus % max.	0,035	0,025
Sulphur % max.	0,035	0,025
Grain refining elements (see Note 2)		
Aluminium (acid soluble) %	0,015 min. (see Note 3)	
Niobium %	0,02 - 0,05	
Vanadium %	0,05 - 0,10	
Titanium %	0,02 max.	
Total (Nb + V + Ti) % (see Note 5)	0,12 max.	
Residual elements		
Nickel % max.	0,40	0,80
Copper % max.	0,35	0,35
Chromium % max.	0,20	0,20
Molybdenum % max.	0,08	0,08
Nitrogen % max.	0,009 (0,012 max. (if Al is present))	

NOTES

- For AH grade steels in all strength levels and thicknesses up to 12,5 mm, the specified minimum manganese content 0,70%.
- The steel is containing aluminium, niobium, vanadium or other suitable grain refining elements, either singly or in any combination. When used singly, the steel is to contain the specified minimum content of the grain refining element. When used in combination, the specified minimum content of each element is not applicable.
- The total aluminium content may be determined instead of the acid soluble content. In such cases the total aluminium content is to be not less than 0,020%.
- Alloying elements other than those listed above are to be included in the approved manufacturing specification.
- The grain refining elements are to be in accordance with the approved specification.

$$CEV = C + \frac{Mn}{6} + \frac{Cr+Mo+V}{5} + \frac{Ni+Cu}{15}$$

$$P_{cm} = C + \frac{Si}{30} + \frac{Mn+Cu+Cr}{20} + \frac{Ni}{60} + \frac{Mo}{15} + \frac{V}{10} + 5B$$